theoretical statements that now permeate much of biology: the Central Dogma, in which information goes from genes to proteins but not vice versa, and the Sequence Hypothesis, which states that the specificity of DNA depends only on the sequence of bases and that sequence alone determines the amino acid sequence in a protein and thereby the protein's three-dimensional structure and function.

I met Francis in 1976, when he moved from Cambridge, England, to the Salk Institute for Biological Studies in La Jolla, California. There, he became a theoretical neuroscientist and followed his second passion, the mystery of consciousness. I saw him at neuroscience meetings and visited him at his summer house, with its golden helix above the front door.

In 1979, Francis and I worked for a month with David Marr at the Salk Institute to try to understand the connection between the architecture of the visual cortex and several intriguing aspects of visual perception. In the process, I observed his remarkably clear thinking and incredibly intense focus. After numerous hours discussing a problem with the solution still escaping us, David and I were tired, confused, and ready to give up for the day. Not Francis; he was relentless, forceful, critical, and enthusiastic. He was not a mathematician, but he knew how to use mathematics and how to visualize it.

Beginning in the 1980s, Francis worked with my first graduate student, Christof Koch, on consciousness. He knew well that solving the problem of consciousness was going to be difficult: He had titled his autobiography *What Mad Pursuit*. Francis and Christof did not manage to solve the problem, but they did show how to attack it in scientific terms and made it a legitimate problem for neuroscientists to tackle. Christof's book, *The Quest for Consciousness: A Neurobiological Approach* (Roberts, 2004), is based on his collaboration with Francis since 1989.

Rationality was Francis's driving force. In fact, he may have been too rational even for his own children, but he was tolerant of people's small superstitions. He did not suffer fools who made claims based on flimsy evidence; for him, scientific theory was to be based on hard facts. At the same time, he was extremely patient with curious people. After a talk, when he must have been quite tired, he gently answered what seemed endless questions from students and others who had stayed after the huge audience had left.

Francis made great discoveries without being eccentric, jealous, self-obsessed, or thirsty for power and fame. He didn't seek a career in administration, nor did he try to build a large research group. One of his own rules, which he strictly followed, was to avoid being too busy and taking on too many commitments. He tried to be somewhat "underemployed," as he called it, so that he would have time to devote to a good problem or idea if one came along. As Watson said in a 1998 interview (quoted in the *New York Times*, 29 July 2004), "Francis . . . never tried to promote himself. He was just interested in solving problems."

In the last years of his life, Francis accepted his disease without worrying about it. His enthusiasm for science and for conversation with friends continued unabated. A few weeks before he died, he talked to me enthusiastically about a paper he and Christof were writing on the possible role of consciousness in a little known brain structure called claustrum.

During the last years, I came to admire Francis as a person as well as a scientist. I marveled at the youthful spirit that he and his wife, Odile, maintained and how refreshing it was to visit with them.

Francis is sorely missed, but his mind will live on through his papers, books, letters, and our own memories.

Tomaso A. Poggio
Massachusetts Institute of Technology
Cambridge

with

Martino D. Poggio
University of California, Santa Barbara

Marshall Nicholas Rosenbluth

Marshall Nicholas Rosenbluth, a brilliant theoretician, died on 28 September 2003 in San Diego, California, after a two-year struggle with pancreatic cancer.

Born on 5 February 1927 in Albany, New York, Rosenbluth graduated from Stuyvesant High School in New York City and maintained an active interest in that institution throughout his life. He enlisted in the US Navy during World War II and graduated from Harvard College in 1946 with a bachelor's degree in physics. Rosenbluth was a leading member of a remarkable group of physics graduate students at the University of Chicago during the postwar era. Four of those students eventually went on to win Nobel Prizes, and the group produced several directors

Marshall Nicholas Rosenbluth

of nationally renowned scientific institutions. In 1949, Rosenbluth earned his PhD in physics under the supervision of Edward Teller. His thesis was in elementary particle physics and dealt with meson interaction theory.

After playing a key role in national defense projects at Los Alamos (1950–56), Rosenbluth began his lifelong concentration on plasma physics and controlled fusion the following year, when he joined the research staff of General Atomics in La Jolla, California. He would continue his connection to GA for the rest of his life. Rosenbluth held professorships at the University of California, San Diego (1960–67); the Institute for Advanced Study (1967–79); and the University of Texas at Austin (1980–87), where he was the founding director of the Institute for Fusion Studies. He returned to UCSD and GA in 1987, and remained active in both institutions until his death. He also was chief scientist (1993–98) of the joint central team for ITER, an international prototype fusion energy reactor.

Rosenbluth was unique in his tremendous strength, breadth, and depth in many areas of theoretical physics. His numerous major achievements included the development of the Monte Carlo Simulation technique, the defining calculation for the scattering of electrons off nucleons (the "Rosenbluth formula"), and the basic theory of the free electron laser. Rosenbluth left his mark on basic plasma physics, all aspects of magnetic confinement theory, inertial confinement, and laser–plasma interaction theory. He was particularly interested in the kinetic foundations and descriptions of macroscopic plasma dynamics.

He was both superbly insightful and a theoretical and calculational virtuoso, known for overnight delivery of key results, usually scribbled on the back of a piece of paper stained with tobacco from his ever-present pipe. He had an unusual knack for simple, elegant minimalistic solutions that cut directly to the heart of an issue. Though he generally avoided ponderous formalism, he readily developed new formalistic methods when the physics problem at hand required them. Rosenbluth was a pragmatic theorist, with a strong interest in and deep knowledge of experiments and was amazingly facile with numbers and magnitudes. He was among the first to grasp the potential of scientific computation as a tool for discovery and progress in physics and was a leading contributor to and promoter of this field from his early work at Los Alamos right up until his death.

In addition to scientific research, Rosenbluth was devoted to serving physics in general and the fusion program in particular. In the fusion arena, he played a key role in US and international programmatic leadership and oversight. He also remained active in defense and disarmament policy and was a member of JASON for more than 30 years. Rosenbluth actively promoted international collaborations in science, beginning with his work at the International Centre for Theoretical Physics in Trieste, Italy. From 1966 to 1967, he led a famous and influential international program there that included leading Soviet scientists; the impact of his leadership is still felt today. Further international collaborative efforts continued later with his participation in the ITER project, to which he remained passionately committed until his death. He also cofounded (in 1980) the US–Japan Joint Institute for Fusion Theory.

Always the teacher, Rosenbluth mentored a large school of students, postdocs, and young scientists. No matter how busy, he made time to advise, nurture, and promote young people. Rosenbluth was also a superb lecturer and speaker, whose seminars were models of insight and clarity.

He was an exemplary member of a group that journalist Tom Brokaw has dubbed "The Greatest Generation." His life experiences in the Depression, World War II, and the postwar era made him an optimist and a believer in the triumph of ability, reason, and effort in the face of adversity. He believed that one person could make a difference.

The most notable of numerous honors Rosenbluth received were the US government's Enrico Fermi Award (1985) and National Medal of Science (1997), the European Geophysical Society's Hannes Alfvén Prize (2002), and the Nicholson Prize for Humanitarian Service (2002), given by the American Physical Society's division of plasma physics.

Rosenbluth genuinely enjoyed human interactions in the course of science and greatly valued the collaboration and camaraderie of scientists worldwide. He enthusiastically participated and led team efforts aimed toward a larger common goal, whether it was in defense, various projects in the fusion program, or in building international scientific bridges during his many visits to Trieste. In addition to his pursuit of science, he was an avid reader and was interested in history, politics, art, music, and opera. He had a keen and penetrating wit, was adept with language, and conceived many humorous anecdotes, jokes, puns, and limericks, for which he is fondly remembered. Rosenbluth's other attractive qualities included compassion, modesty, consideration, and grace under pressure. He is, and will continue to be, sorely missed.

Patrick H. Diamond
Marvin L. Goldberger
University of California, San Diego
La Jolla
Roald Z. Sagdeev
University of Maryland, College Park
Herbert L. Berk
University of Texas at Austin

Richard Bersohn

Richard Bersohn, a chemical physicist best known for his elegant, powerfully simple studies of molecular photodissociation and chemical kinetics, died of cancer on 18 November 2003 in New York City. He was the Higgins Professor of Natural Science at Columbia University.

Born 13 May 1925 on the Upper West Side of Manhattan in New York City, Richard earned his BS in chemistry from MIT at age 19. After receiving his degree, he entered the US Army, passed through basic training, and then worked on chemical separations at Clinton National Laboratory (now Oak Ridge National Laboratory) as part of the Manhattan Project.

Deeply interested in physics, Richard began his theoretical studies in 1946 as a student of John Van Vleck at Harvard University. He did his PhD thesis on dipole interactions in nuclear magnetic resonance (NMR), which had just been discovered in Edward Purcell's laboratory at Harvard. In 1949, he